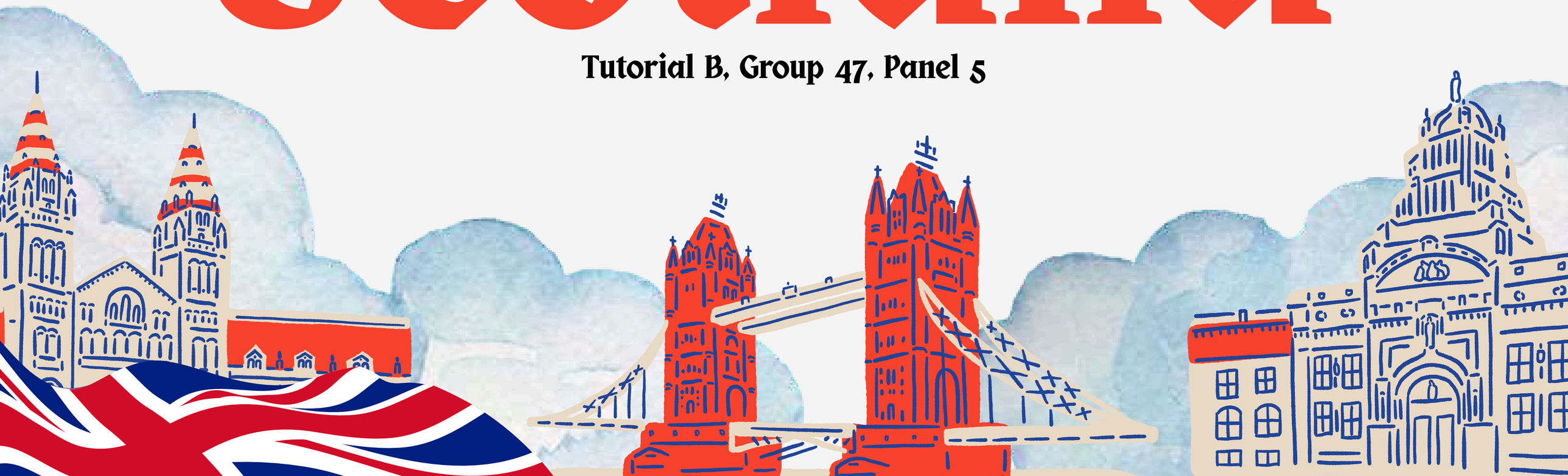
Briefing 1: An International Hub in Central Scotland

COUNTRY INTRODUCTION

Scotland

Tutorial B, Group 47, Panel 5



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Introduction

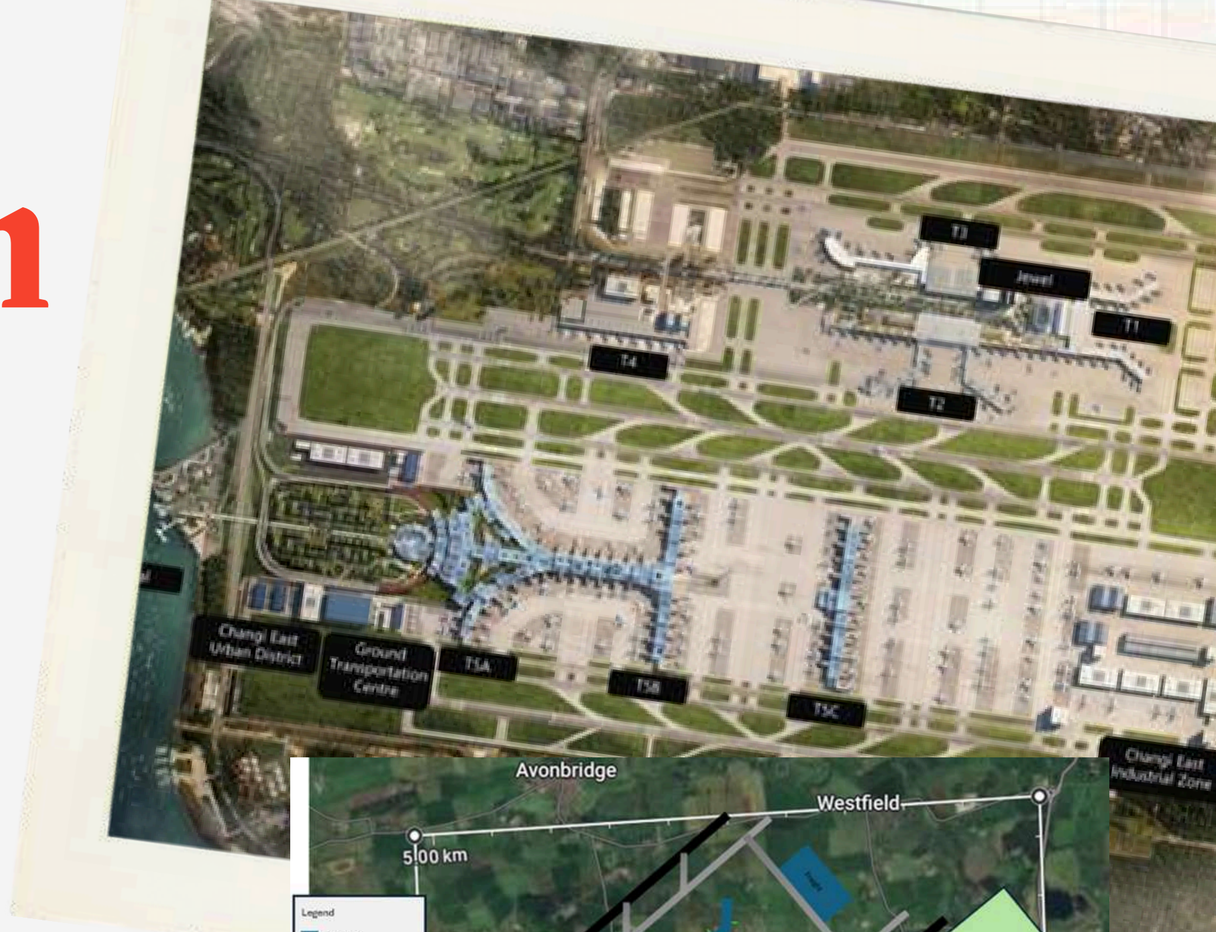
Goals:

1. Select a suitable location for the international hub
2. Design an airport which is able to sustain high traffic

Concept-Design process

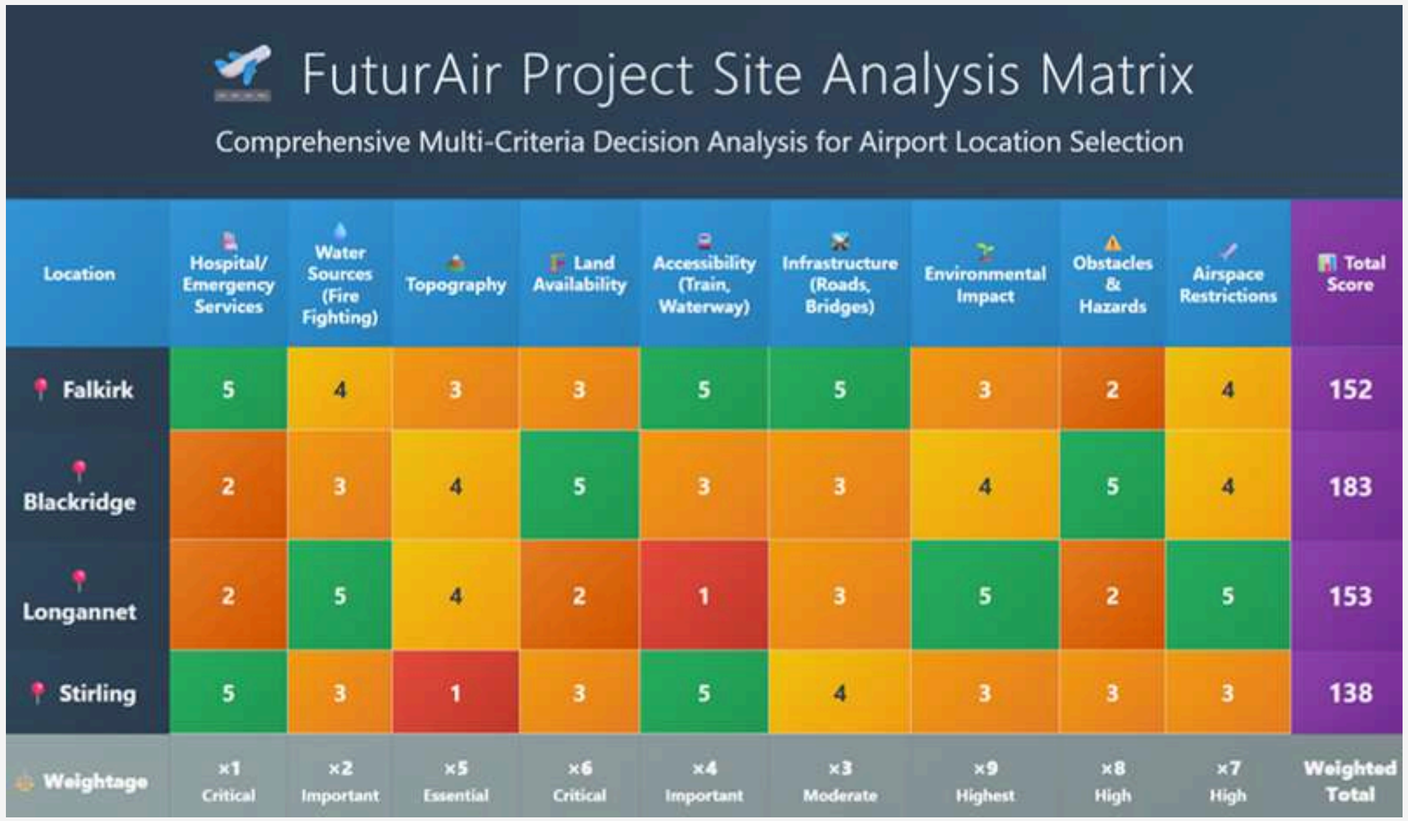
Main inspiration:

1. Singapore Changi airport
2. London Heathrow



Site analysis

Decision matrix



FuturAir Project Site Analysis Matrix

Comprehensive Multi-Criteria Decision Analysis for Airport Location Selection

Location	Hospital/ Emergency Services	Water Sources (Fire Fighting)	Topography	Land Availability	Accessibility (Train, Waterway)	Infrastructure (Roads, Bridges)	Environmental Impact	Obstacles & Hazards	Airspace Restrictions	Total Score
Falkirk	5	4	3	3	5	5	3	2	4	152
Blackridge	2	3	4	5	3	3	4	5	4	183
Longannet	2	5	4	2	1	3	5	2	5	153
Stirling	5	3	1	3	5	4	3	3	3	138
Weightage	×1 Critical	×2 Important	×5 Essential	×6 Critical	×4 Important	×3 Moderate	×9 Highest	×8 High	×7 High	Weighted Total

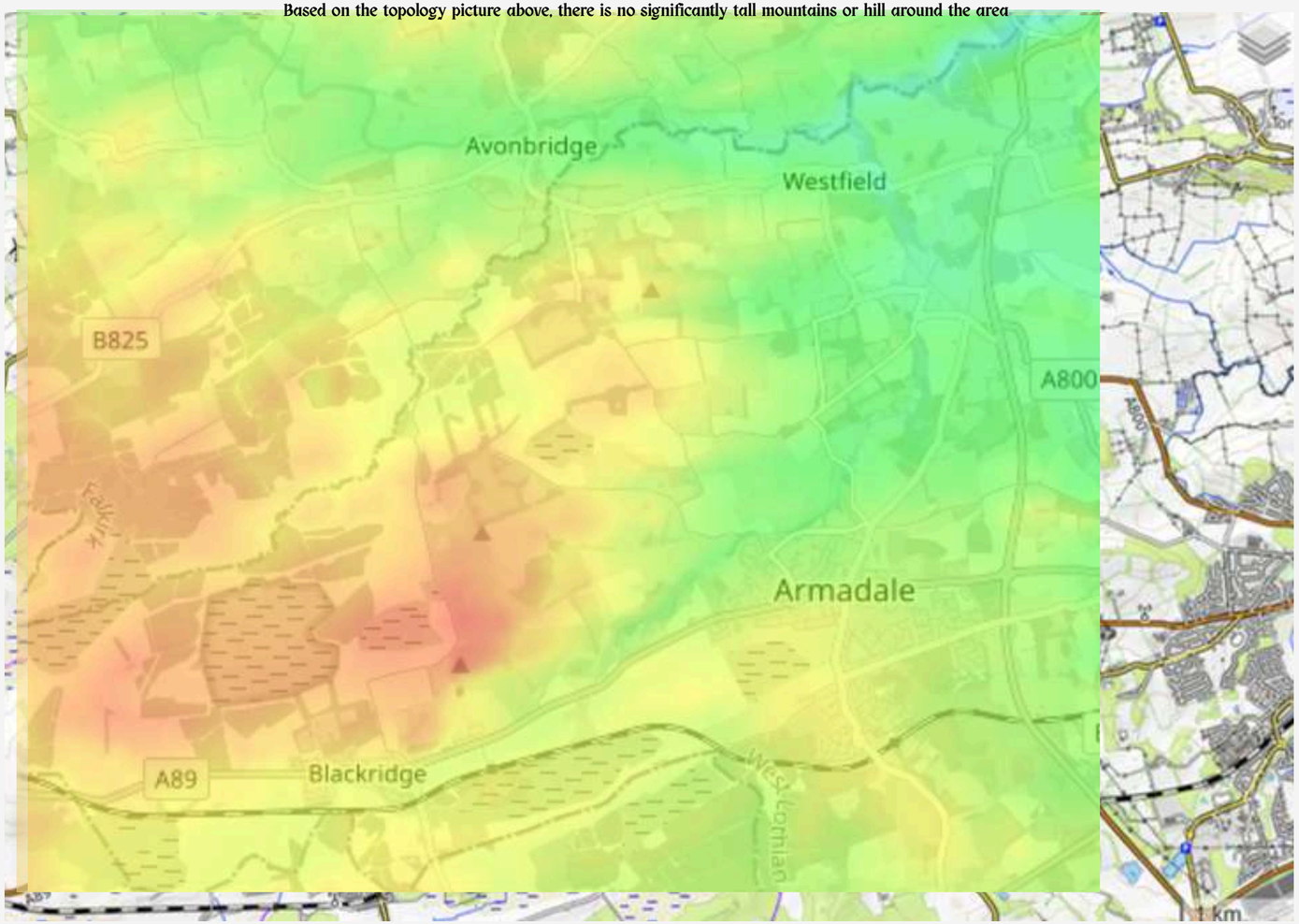
Four Main Location

1. Falkirk
2. Blackridge
3. Longannet
4. Stirling

Site-Analysis (Layout)

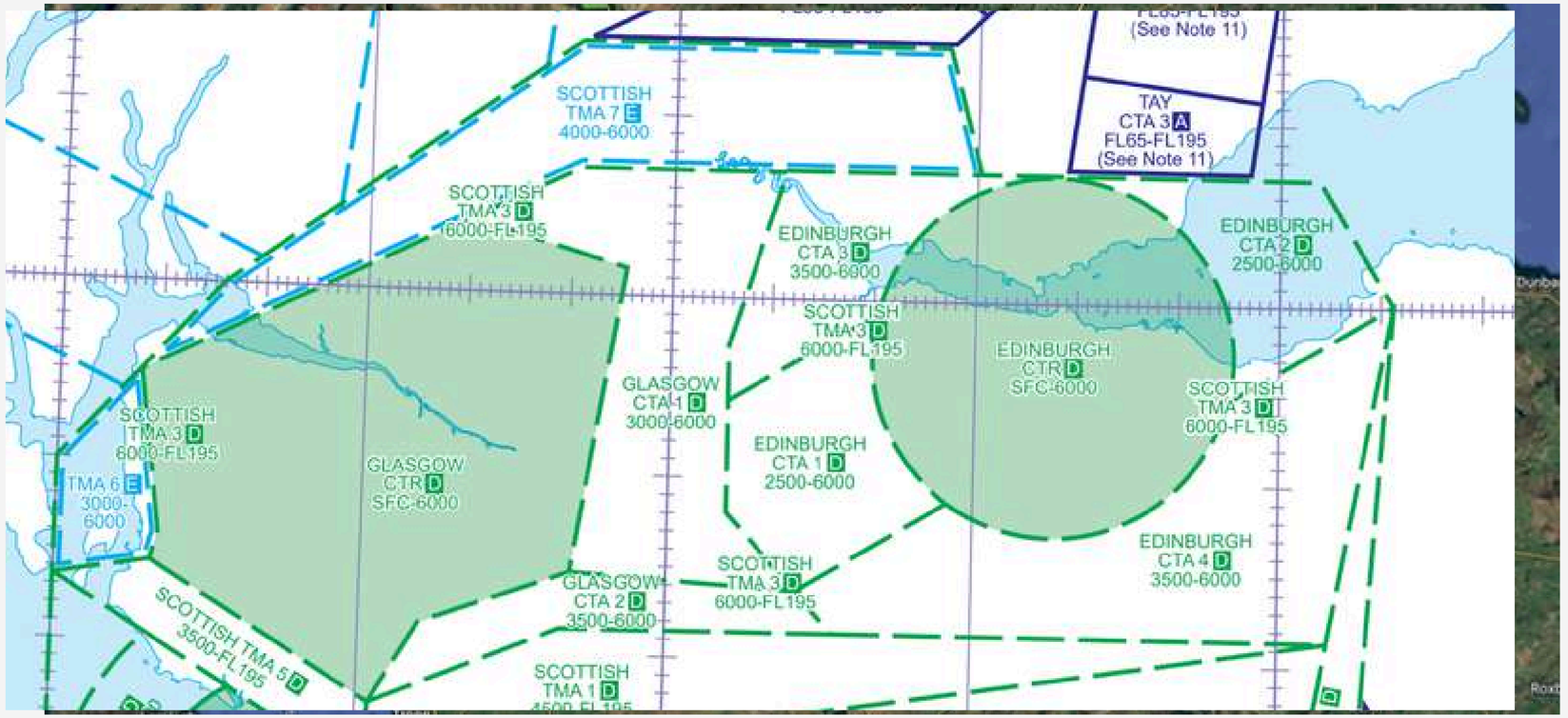
Site-Analysis (Topology)

Based on the topology picture above, there is no significantly tall mountains or hill around the area



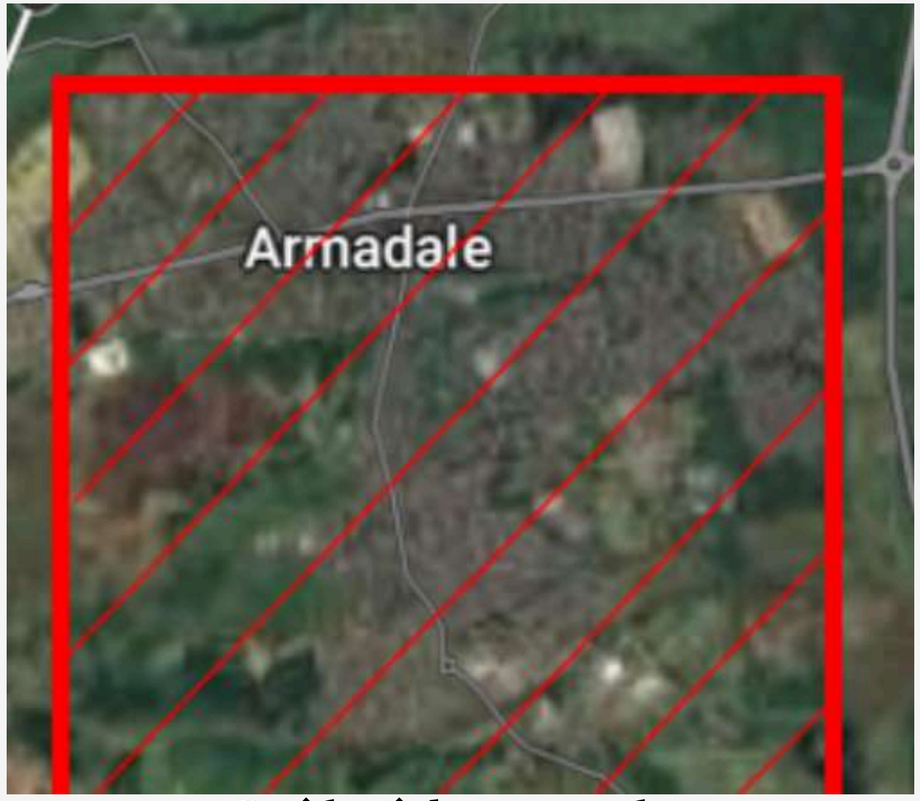
Site-Analysis

Site-Analysis (Air-Space)



Site-Analysis (Restriction)

Protected area: Nature reserve



Residential area nearby

Environmental/ Sustainablilty strategy

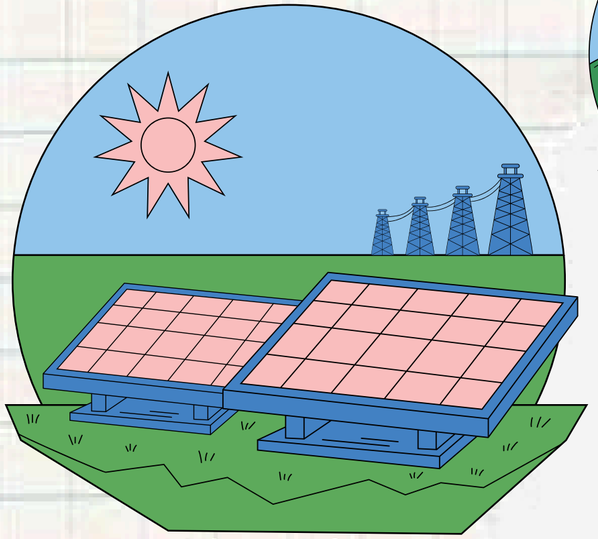
Environment

minimize airport effect on environmental impact

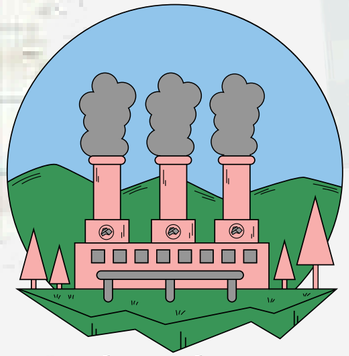
Piezoelectric tiles

Energy Source

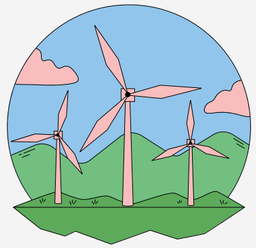
Revolving doors to generate electricity



Solar panel



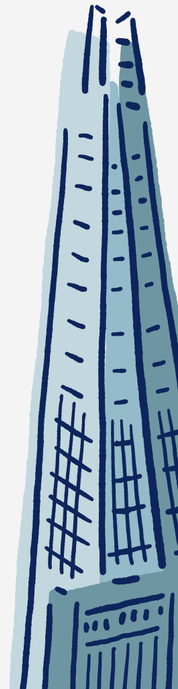
Geothermal energy



WIndmill

- Cogeneration/Trigeneration
- Hydrogen Fuel Cells (Research phase)

Kinetic energy recovery in runways

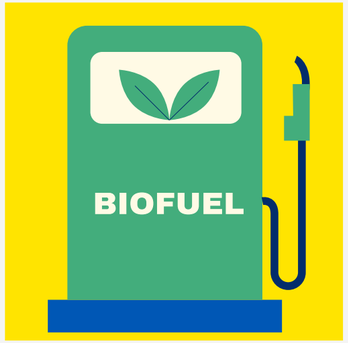


Environmental/ Sustainablilty strategy

Environment

Sustainable aviation fuels

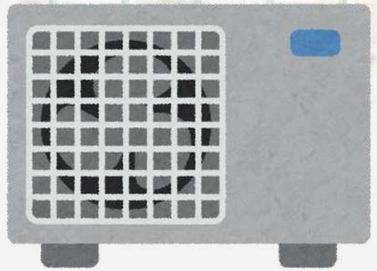
Hydrogen fuels



Biofuel

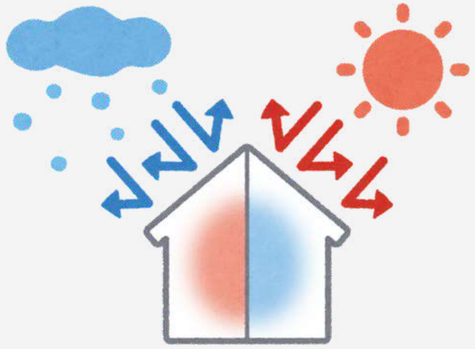
Electric propulsion
(battery electric aircraft)

Energy Efficiency Appliances



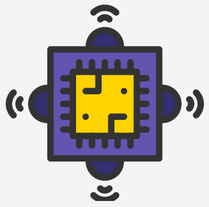
HVAC

Smart thermostat



Building insulation

LED Lights



Motion Sensor

Data analytics with AI

Environmental/ Sustainablilty strategy

Sustainability

Trees/Landscaping

Transport

Water saving

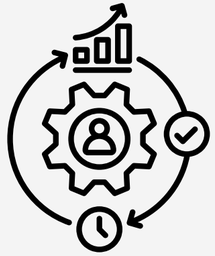
Rainwater Harvesting

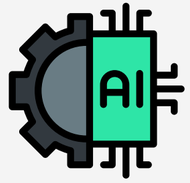
Waste management

Compose bin

Recycling bin

Smart Technology





Smart energy management system

EVs bus and car with charging station

Trains for connectivity

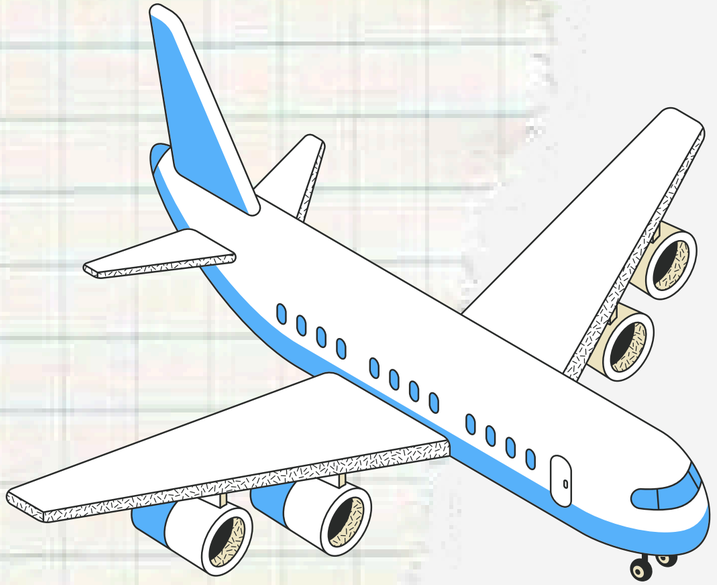
Airport and Aircraft type

Based on ICAO reference, airport type is Code 4F

Which is:

- Airplane length>1800m
- Airplane wingspan >65m up to 79m

Largest plane is Boeing 747-800

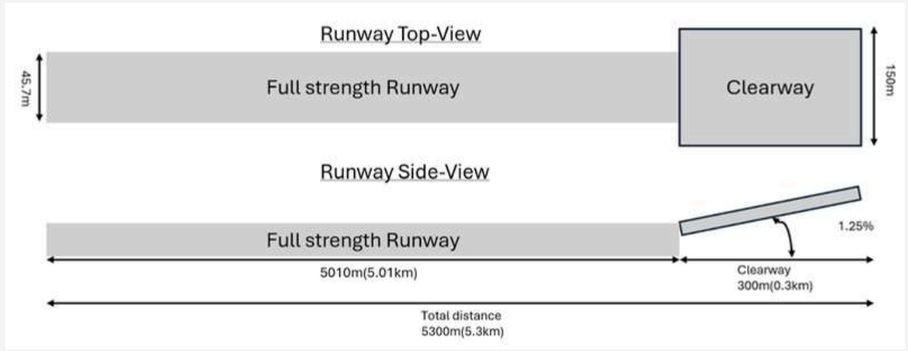


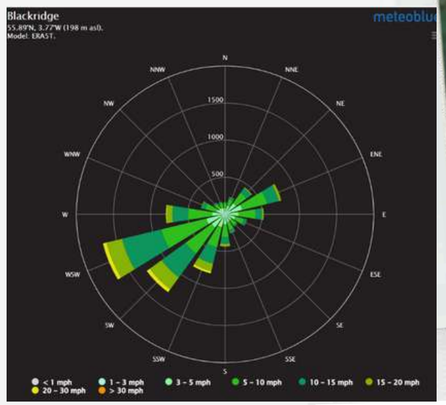
Regional Aircraft(short to medium-haul fewer than 100 passengers)
Boeing 727-200/ 727-100/ 717
Medium Range Aircraft (medium-haul passenger numbers more than 100.)
Boeing 707-120B/ 767-300
Airbus 300
Long Range Aircraft(Can fly distances exceeding 8,000km)
Boeing 747-400/300/400M/400ER
Airbus 340-500/ 600
Airbus 380-800
Boeing 777-200/ 767-400/ 767-400ER
Airbus 330-300/ 330-200
Cargo Aircraft
Boeing 777F
Airbus 380-800F

List not in ascending order of size

Mechanical

Runway





Runway orientation: West Southwest 240˚

Runway direction: 06/24

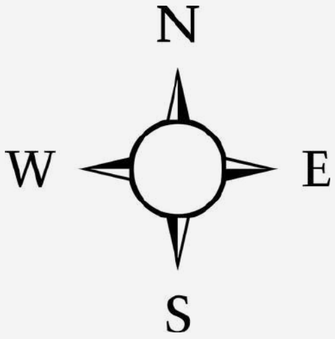
Runway 1: 3.43km to 5.01km

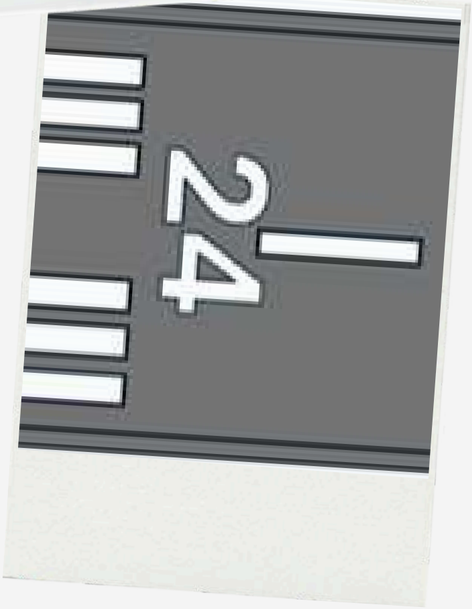
Runway 2: 3.39km to 5.01km

Taxiway Width: 25m

Runway Gradient:

- **Runway 1:12.3134m(1.786%)**
- **Runway 2:10.13574m (1.548%)**

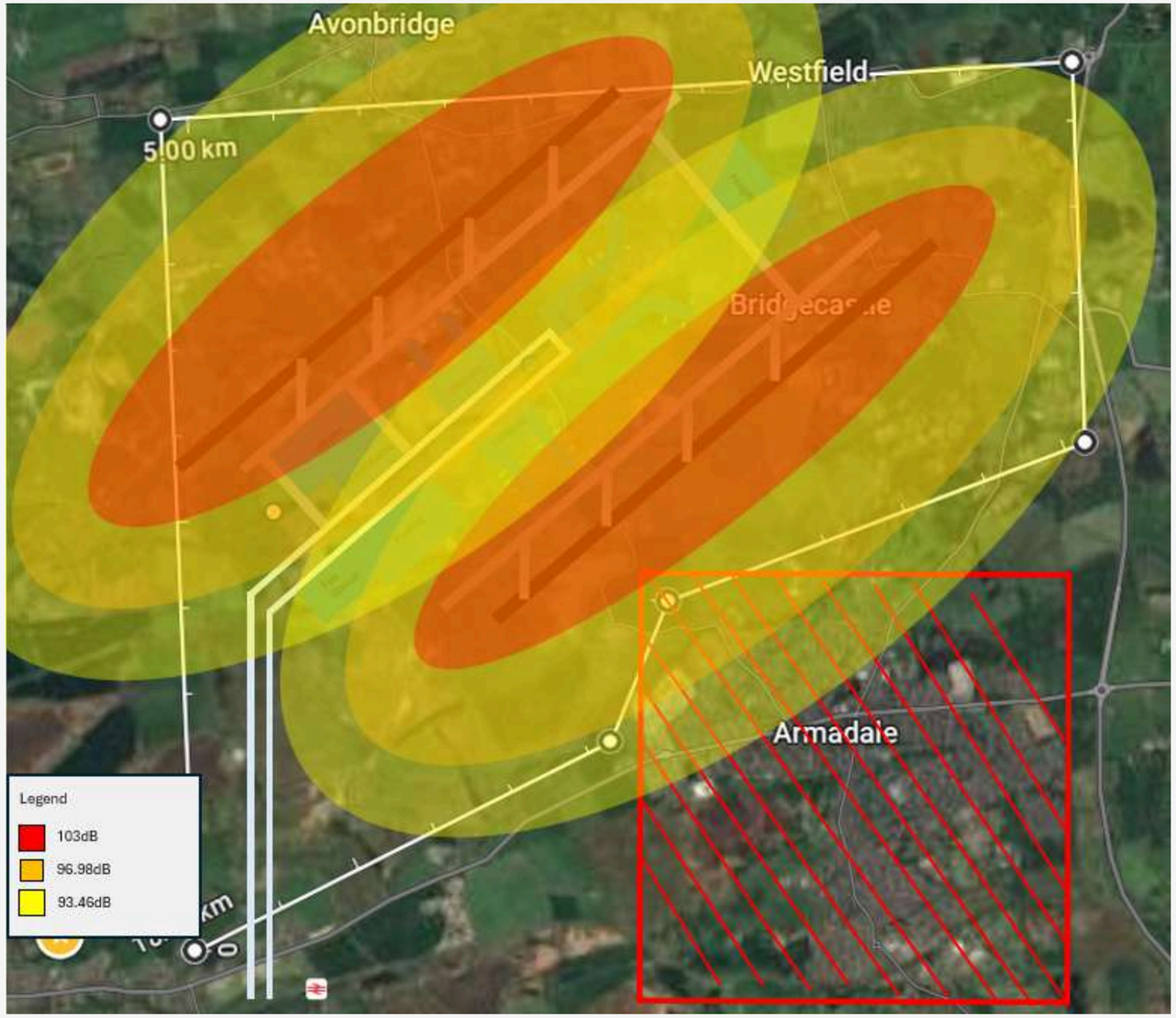




Mechanical

Noise contour

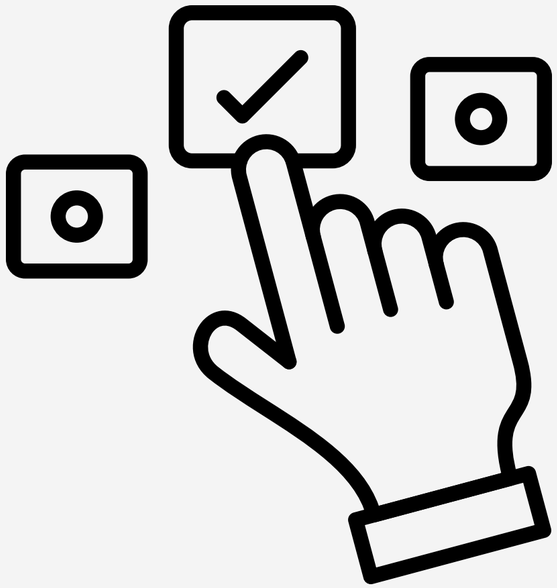
Distance	Noise
450m	103 dB
900m	96.98 dB
1350m	93.46 dB
1800m	90.96 dB



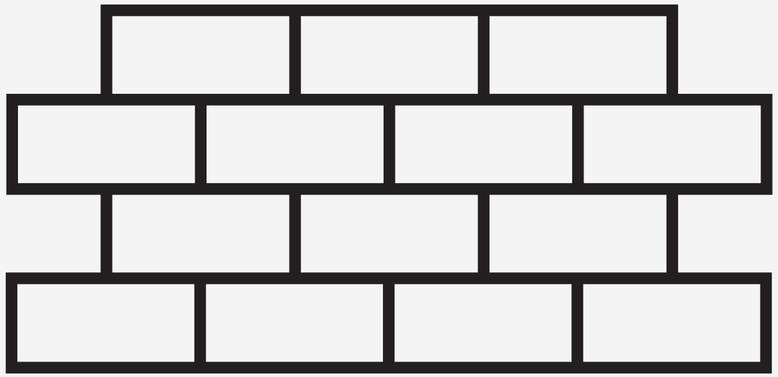
Mechanical

Noise mitigation strategies

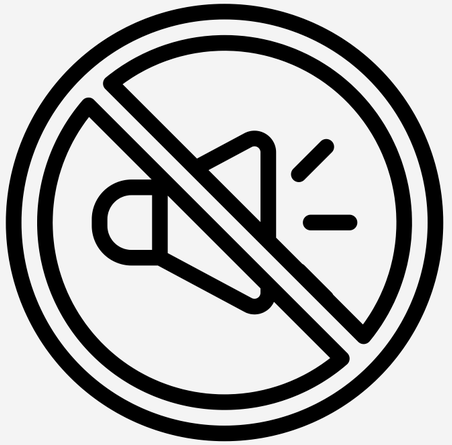
Runway preference



Barrier / Walls

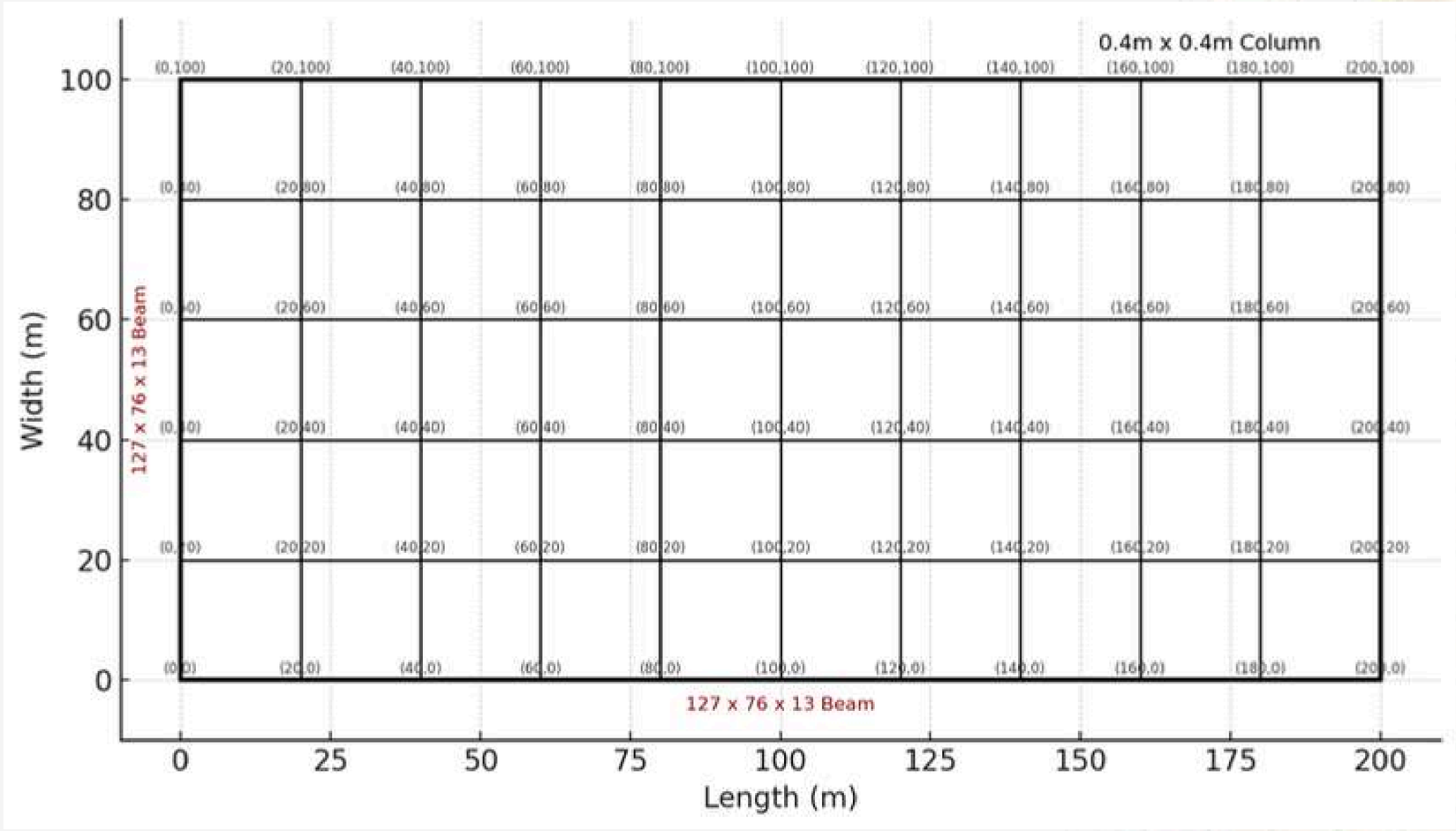


Noise abatement techniques



Civil

Column Grid



Size of Terminal Building:
200 x 100 x 10 m

0.4 x 0.4m concrete columns with 20m spacing

127 x 76 x 13
Steel I-beams

0.13m thick reinforced concrete slab

66 columns

Material Selection

Component	Materials	Explanation
Foundation	In-Situ Concrete	Adequate strength and stability
Exterior Walls	Tempered Glass	High strength, modern aesthetics and thermal resistance
Curtain wall framing	Aluminium	Lightweight strength, design flexibility and recyclable
Column, Footings	Precast Concrete	Fire performance, durability and load bearing
Roof	Cross-laminated Timber	Excellent strength and durability, lowers carbon emission

SFP

Zone	Area/Person (m2)	Units	No. of Users	Total Area(m2)
Terminal Building				**10,429**
Airline ticketing office	3	3	100	750
Entrance	3	3	500	4500
Shops	25	7	100	1750
ATM Booths	2	2	6	24
Male Toilet	5	4	20	400
Female Toilet	5	4	20	400
Information on flight details	3	2	100	600
Waiting area	3	5	100	1500
Escalator	1	8	30	240
Lift	1	8	30	240
Information Desk	25	1	10	25
Departure Area				**8120**
Baggage Trolley Parking	15	8	50	600
Passenger lobby	2	10	200	4000
Check-in Counter	1	6	400	2400
Self check-in zone	15	16	5	120
Security Check	1	2	500	1000
Boarding Area				**17,633**
Boarding Gate	1.785	15	300	8033
Holdroom	2	10	300	6000
Male Toilet	5	5	30	750
Female Toilet	5	5	30	750
Shops	3	3	100	900
Lounges	3	2	200	1200

Total Area of Terminal Building: 36,182 m^2

Carbon Emission

Material	Material Type	Material Specification	Structural Element	Description	Component Lifespan [years]	Temporary Works	% of Temp Works Wasted	Volume [m³] or Mass [kg]?	Material Quantity [m³, kg]	Reinforcement [kg/m³]	Element Embodied Carbon [$kgCO_2e$]	A1-A3
Concrete	Precast_concrete	Reinforced - 150mm hollow core slab	1.1Piling	Columns	60	No		Mass [kg]	474,000		91	69
Concrete	Insitu	UK C32/40 (25% GGBS)	1.1Lowest floor/slab	Ground	60	No		Mass [kg]	6,240,000	Mass Concrete (3)	940	740
Timber	Manufactured_structural_timber	UK CLT 100% FSC/PEFC	2.3 Roof	Roof	60	No		Mass [kg]	1,300,000		575	325
Concrete	Precast_concrete	Reinforced - 150mm hollow core slab	1.1Piling	Column Footings	60	No		Mass [kg]	468,290		102	77
Other	Glass	Toughened	2.5 Structural ext. walls	Exterior Walls	60	No		Mass [kg]	120,000		297	200
Other	Aluminium	Extruded profile - European - 35% recycled cont	2.7 Structural ext. walls	Interior Walls	60	No		Mass [kg]	16,092		158	150
Steel	Rebar	UK 97% recycled EAF production	1.1Piling	Column Reinforcement	60	No		Mass [kg]	4,345		4	3
Steel	Rebar	UK 97% recycled EAF production	1.1Lowest floor/slab	Ground Reinforcement	60	No		Mass [kg]	1,570,000		1339	993
Steel	Rebar	UK 97% recycled EAF production	1.1Piling	Column Footings Reinforcement	60	No		Mass [kg]	11,657		10	9
1.1Excavation Foundation								Mass [kg]	3,180,000		25	
1.1Excavation Other												

	A1a
Global Values [$kgCO_2e$]	0

	A
Total [tCO_2e]	3224

Net Embodied Carbon: 3,420 tons

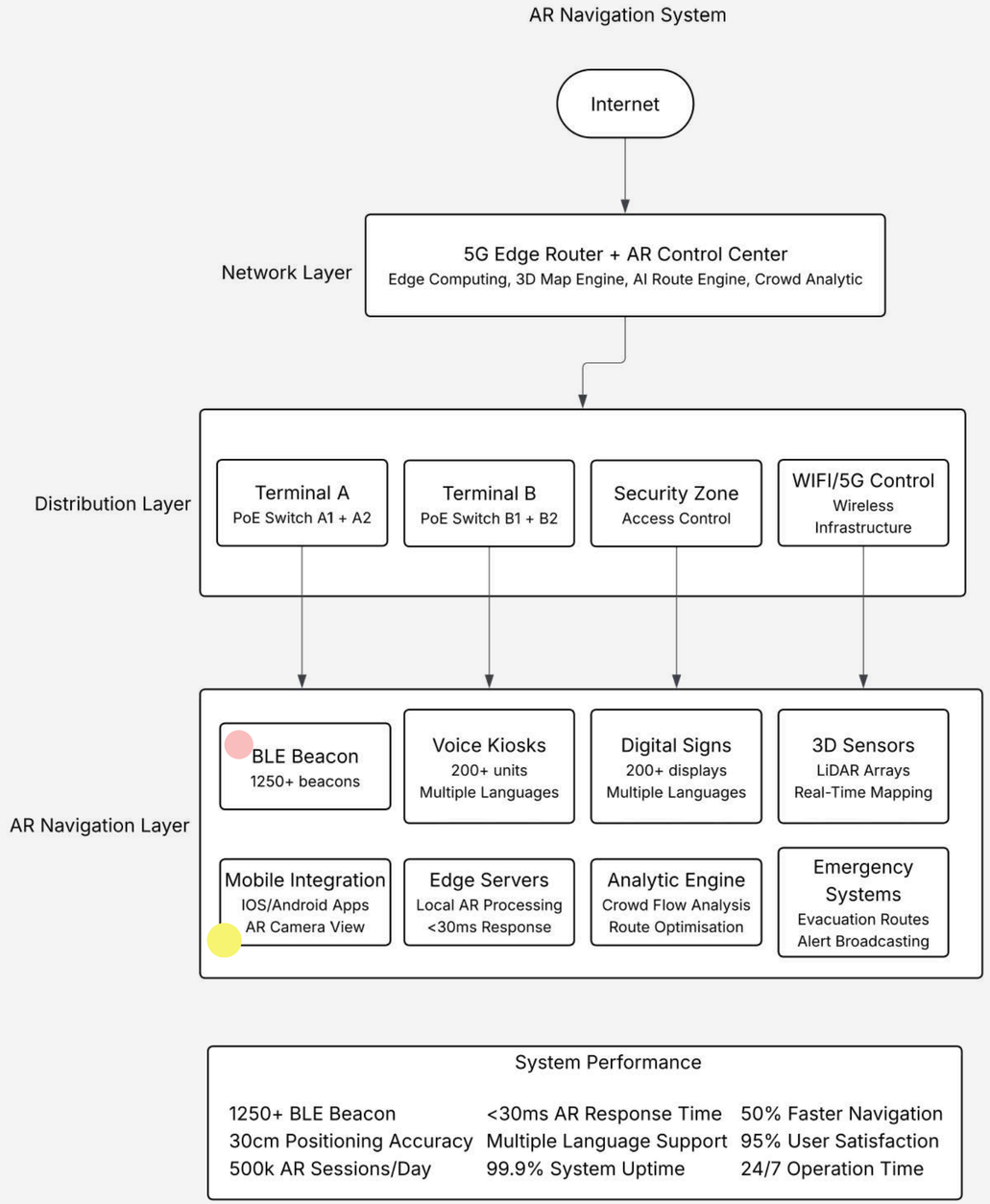
Carbon Emission of Each Material

Material	Material Quantity (kg)	Element Embodied Carbon (tCO2e)
Precast Concrete	881,09	193
In-Situ Concrete	6,240,000	940
Cross-laminated Timber	1,300,000	575
Glass	120	217
Aluminium	16,092	114
Steel	1,585,802	1353

Computer Science

AR Navigation System

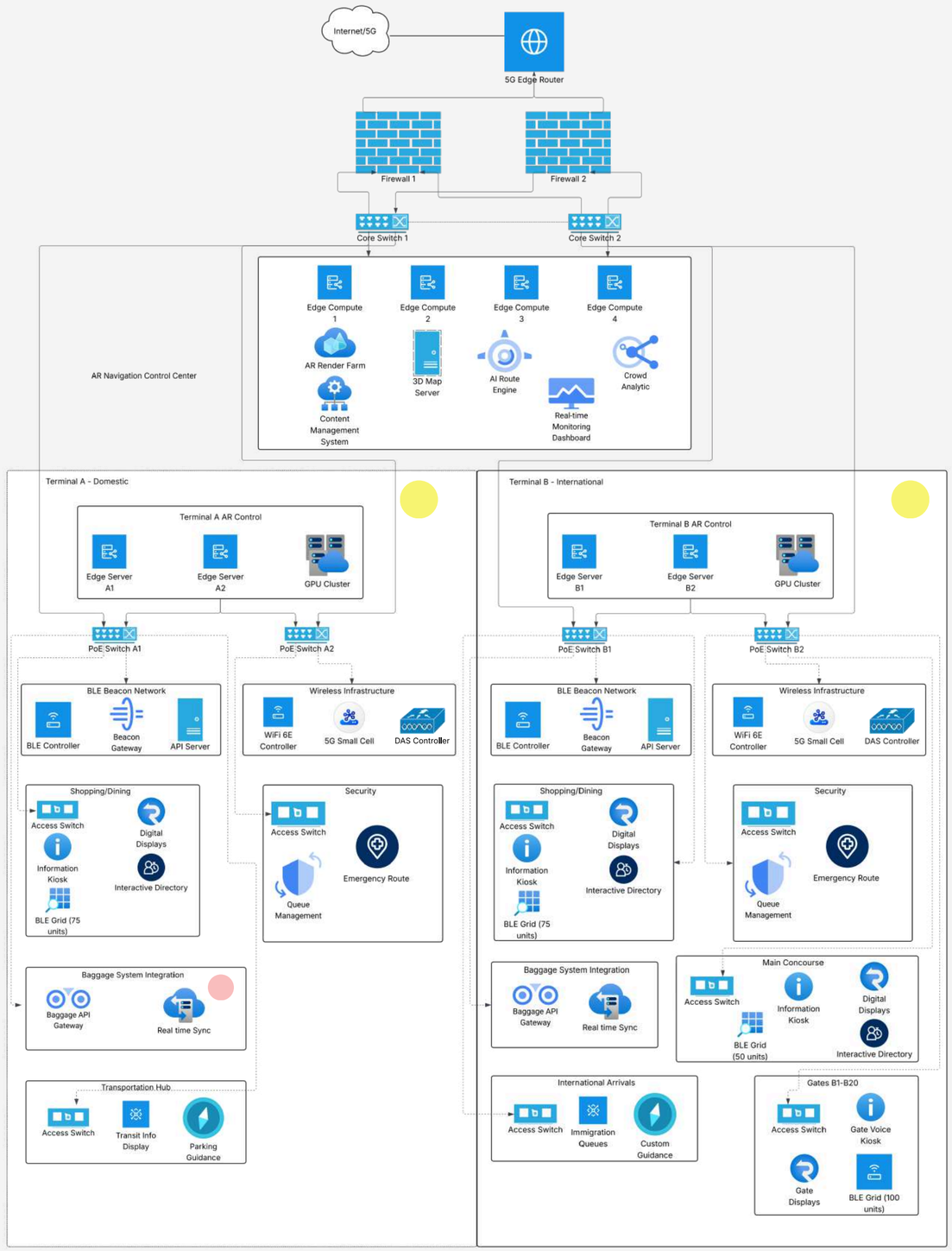
- 1000+ small wireless beacons
- Within 30cm
- Floating arrows and directions
- Voice Kiosks



Computer Science

AR Navigation System

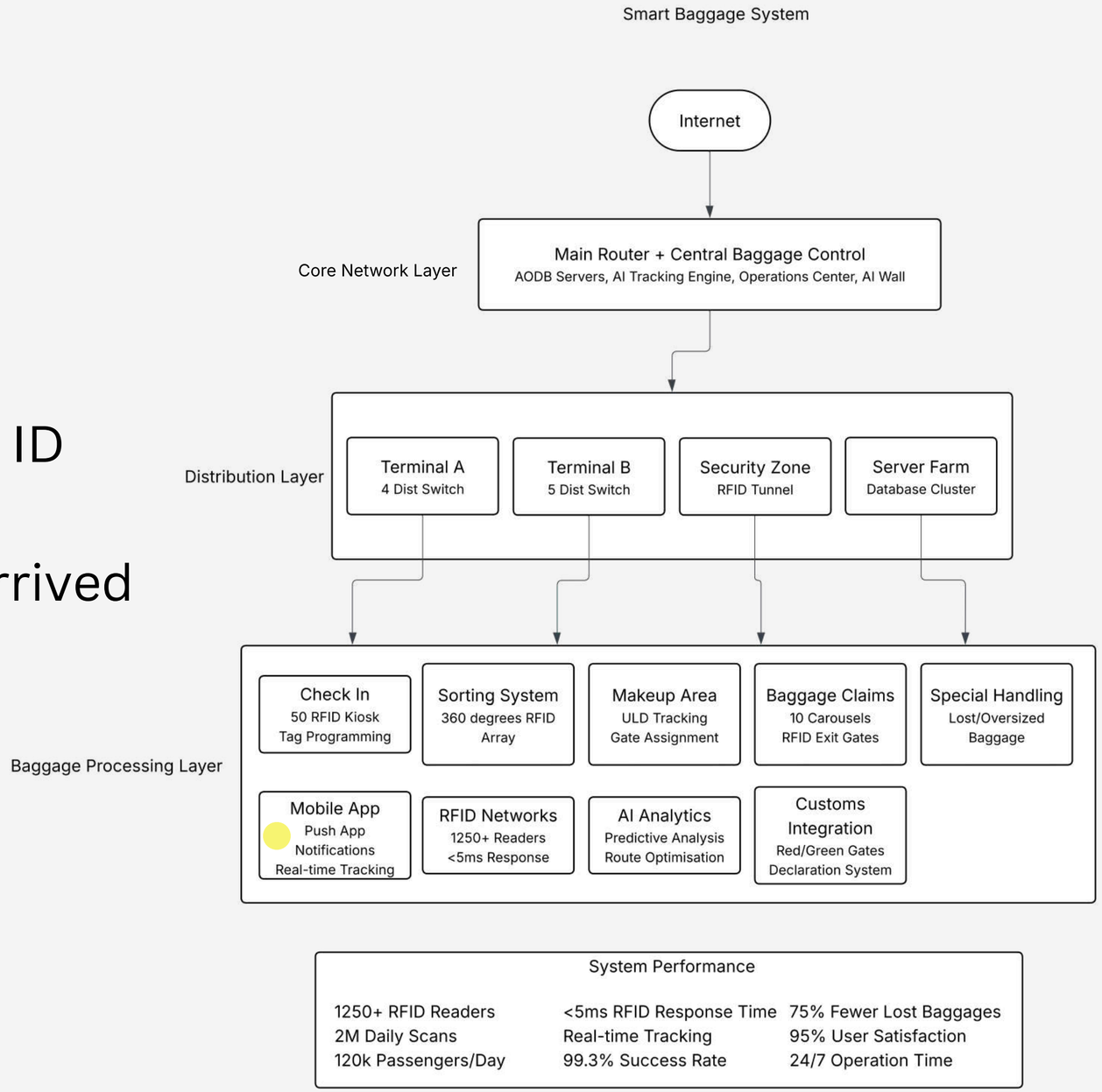
- Process location
- Calculates best route eg, crowds and obstacles
- Smart Network
- Connects with Smart System Baggage eg, delayed



Computer Science

Smart Baggage System

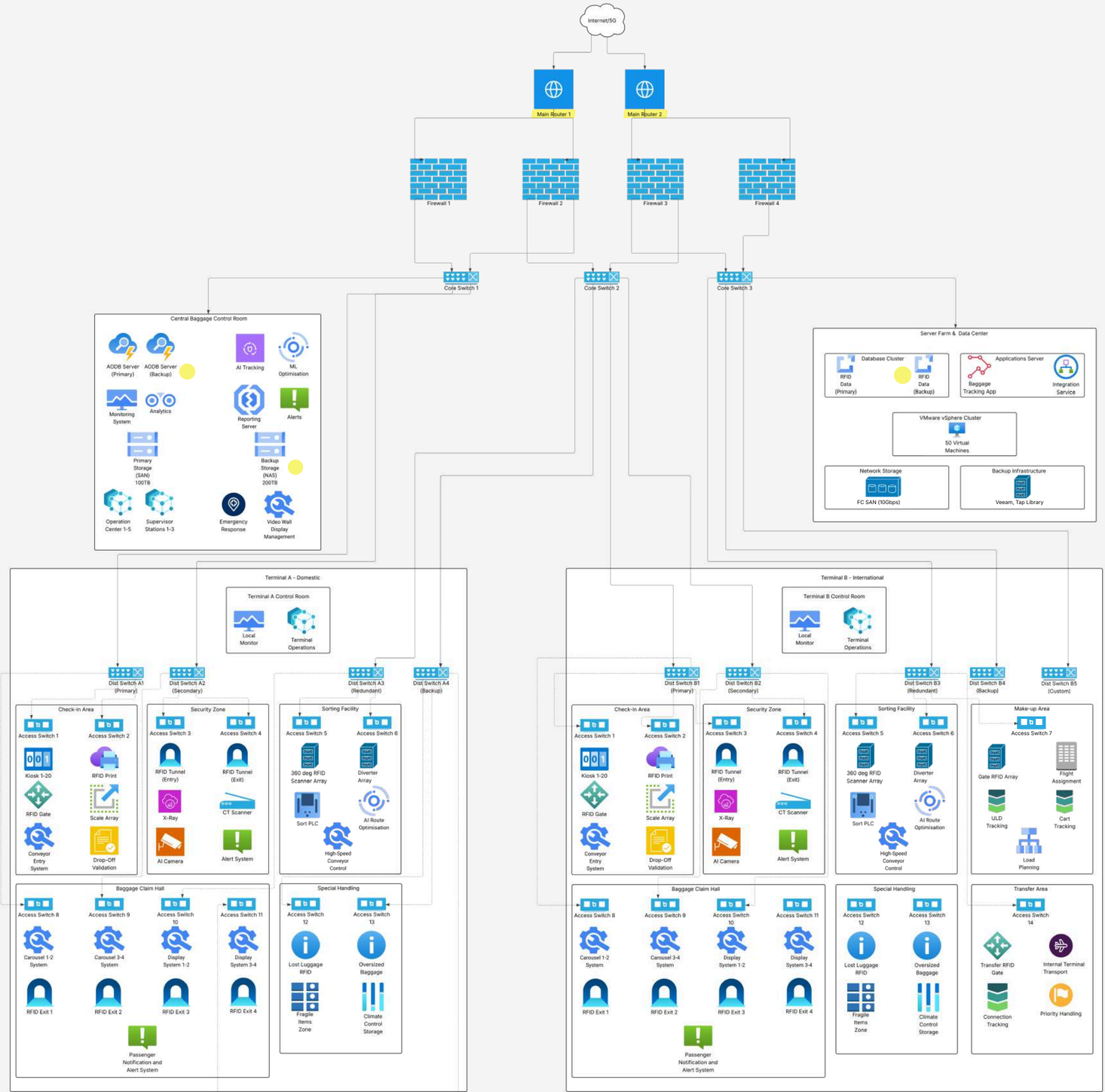
- RFID Smart Tag with Unique ID
- Security, Sorting, Loading
- Real-time eg, bag cleared, arrived at destination
- 75% fewer lost bags



Computer Science

Smart Baggage System

- Check in, directions, bag loading, receive gate directions, guide to correct baggage
- Backup systems



Computer Science

CCTV Security System

Operational Requirements

- Surveillance site - Immigration hall
- Target group - Inbound passengers
- Observation zone and category:
    - Queuing area - Recognition
    - Immigration counters - Identification
- Operation time - 24/7

Image Requirements

- Resolution - 4K(8MP)
- Frame rate - 15fps
- Storage and Retention
  - Format: H.265-encoded 4K video
  - Retention period:
    - Onsite - 30 days
    - Offsite - 90 days
- Encryption: AES-256

Hardware Selection

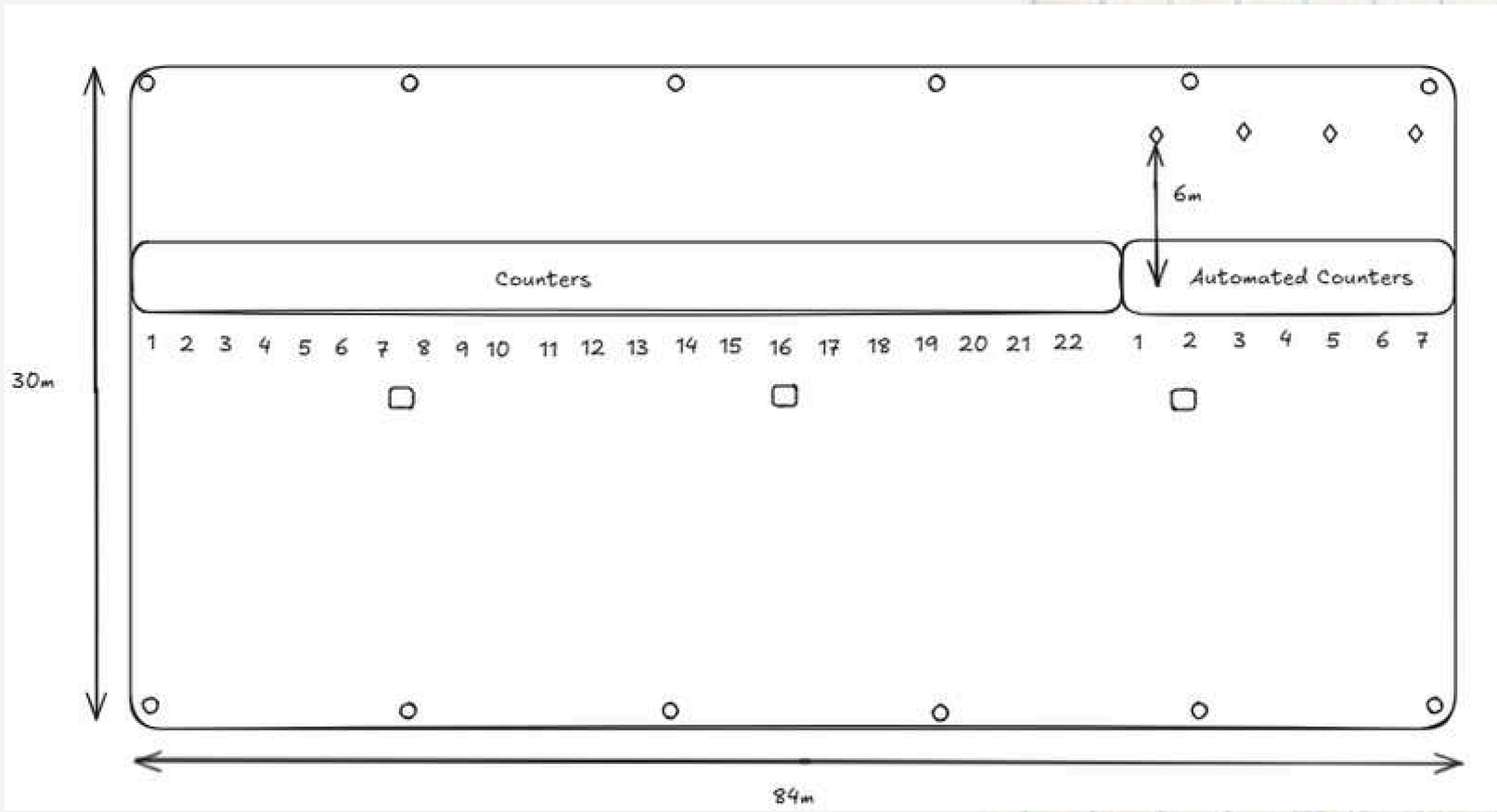
- Dome camera for overall surveillance
- Bullet camera for automated gates identification
- PTZ camera for redundancy and blind spots coverage

CCTV Layout

Circle - Dome

Square - PTZ

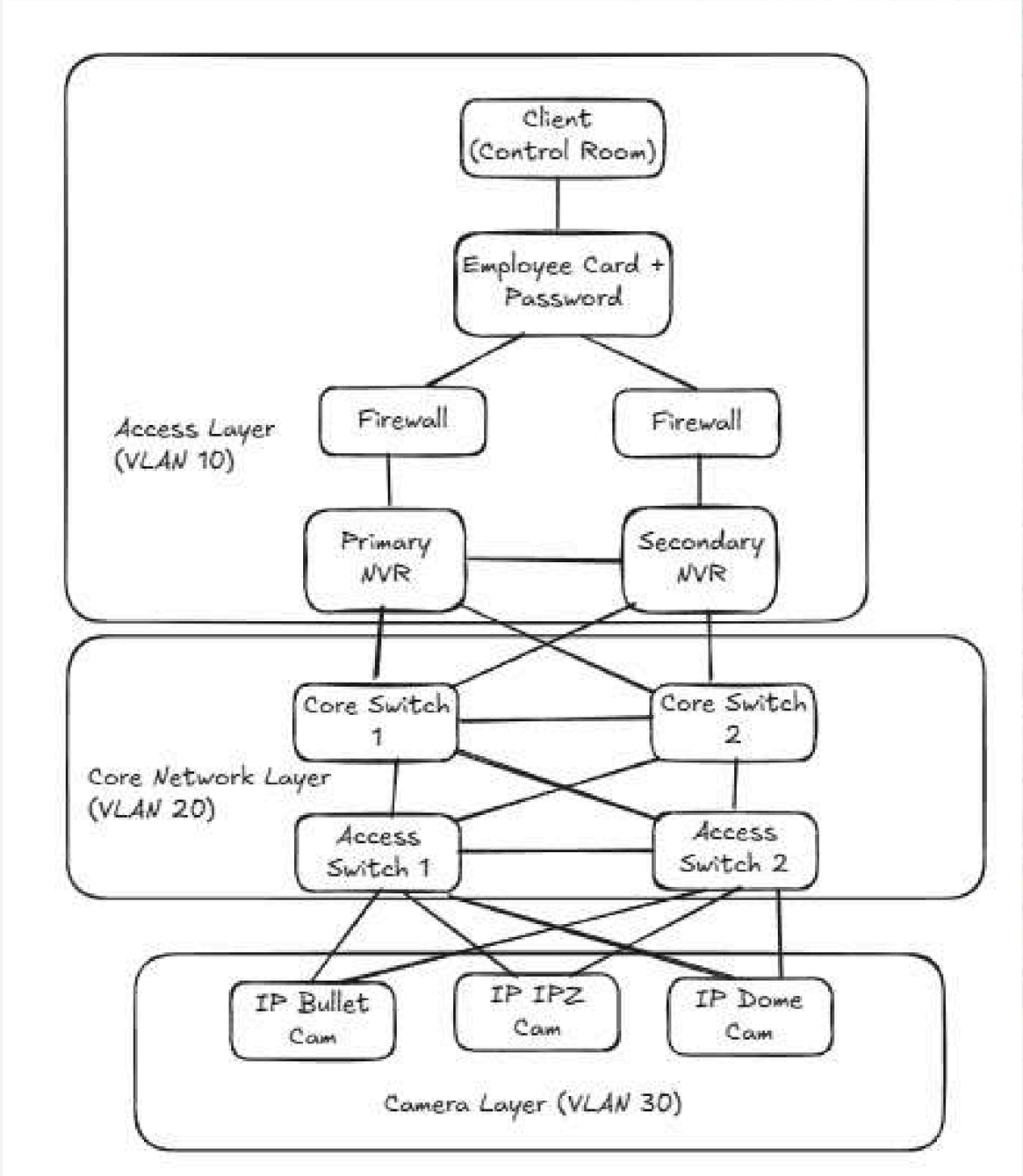
Diamond - Bullet



Storage Requirements

- Bandwidth - 176.128Mbps
- Storage required per month - 57.07TB
- Offsite storage requirement - 171.21TB

Network Architecture



Conclusion

- Strategic location
- Future ready infrastructure
- Sustainability and inclusivity
- Enhanced user experience and security

Thank You!

Done By:
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